REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF MINERALS AND ENERGY
EXAMINATION FOR THE MINE SURVEYORS CERTIFICATE OF COMPETENCY

DATE: 13 October 2005 (Thursday) TOTAL MARKS: **100**
TIME: 8:30 to 11:30 (3 Hours) TO PASS: **50**

MATHEMATICS

Note: (1) The make and model number of your calculator must be shown on the front cover of your answer book.
(2) All steps must be shown.

QUESTION 1

Simplify:

(a) $\dfrac{a^{x+3} + 2a^x}{a^{3x} - 4a^x} \cdot (a^x - 2)$ (4)

(b) $\dfrac{x^2 - x - 12}{x^2 + 7x + 12}$ (3)

(c) $\dfrac{4^n.2^{n+2} - 8^n}{2^2.3^0.2^{3n}}$ (3)

[10 marks]

QUESTION 2

Solve for x:

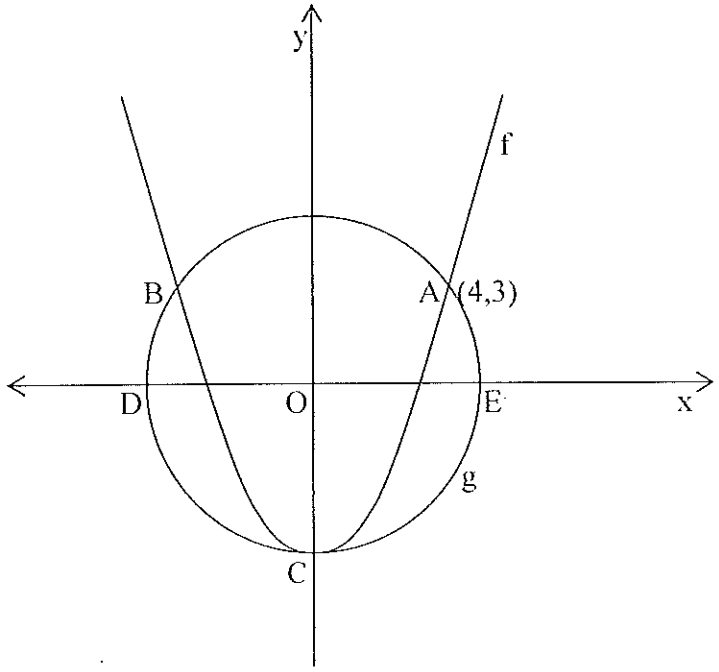
(a) $\sqrt{x+2} + 4 = x$ (5)

(b) $\dfrac{1}{x-2} + \dfrac{2}{x+2} = \dfrac{3}{x+1}$ (4)

(c) $2^{x+2} + 2^{x-2} + 2^x = 42$ (6)

[15 marks]

QUESTION 3



(a) Determine the co-ordinates of B. (1)

(b) Find the length of OA. (2)

(c) Determine the co-ordinates of C, D and E. (3)

(d) Determine the equation of the parabola f and the circle g. (5)

[11 marks]

QUESTION 4

If 10; a; 24; b; 38; … is an arithmetic progression, determine:

(a) the values of a and b (4)

(b) the first six terms (2)

(c) the value of the 10^{th} term. (3)

(d) which term is equal to 150. (4)

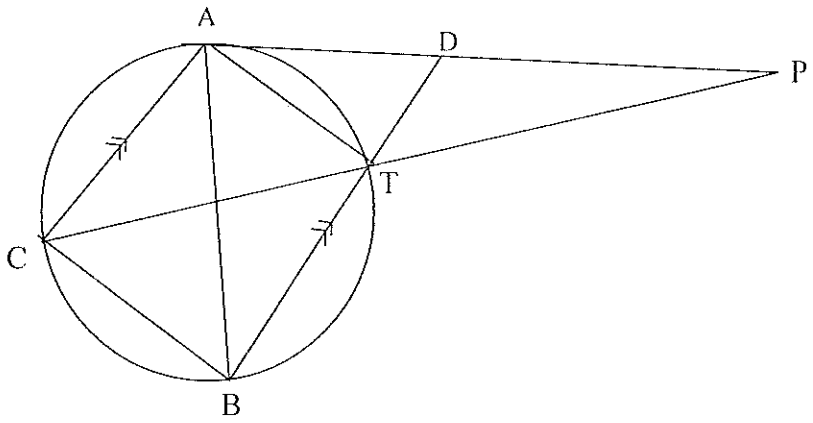
[13 marks]

QUESTION 5

In the figure below, PA is a tangent and CA // BT.
Prove that :

(a) Δ ABC /// Δ ADT. (5)

(b) PT is a tangent to circle ADT. (5)



[10 marks]

QUESTION 6

If $\tan\left(\frac{x}{2}\right) = t$, express the following in terms of t :

(a) tan x (3)

(b) cos x (4)

(c) sin x (3)

[10 marks]

QUESTION 7

Prove the following :

(a) $\sin^2\theta + \cos^2\theta = 1$ (5)

(b) $\dfrac{2\sin^2 x}{2\tan x - \sin x} = \cot x$ (6)

[11 marks]

QUESTION 8

Let $f(x) = x^2 + 2$.

(a) Find the average gradient between two points (a, f(a)) and (a+h, f(a+h)). (5)

(b) Hence find the average gradient between (1,3) and (3,11). (2)

[7 marks]

QUESTION 9

Determine the derivatives of the following by using the rules of differentiation.

(a) $y = -\dfrac{3}{x^7}$ (3)

(b) $y = \dfrac{3x^2 + 4x^5}{x^3}$ (3)

(c) $y = \sin^2(7x-4)$ (4)

(d) $y = 3x^{\frac{1}{2}} - \frac{1}{2} + x^{-1} - \dfrac{x^{-2}}{6}$ (3)

[13 marks]

TOTAL **[100 Marks]**